

Improving return on investment in higher education retention: Leveraging data analytics insights

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This article describes data analytics action research initiatives that have gained traction at a university in Western Australia, with a focus on the return on investment of improving retention. In this report we focus on how actionable data can be provided and insights supported to the right stakeholders at various levels of the organization. The article will detail experiences with three levels of initiatives that have been implemented at the university: high level insights being delivered to faculty staff, the provision of integrated reports for lecturing staff, and the curation of 'at-risk' student lists for triage by student support staff. In conclusion, higher education institutions may consider five dimensions of learning and teaching operations: finding and selecting students; knowing learners and their expectations; just-in-time services, content, mentoring and support; anytime, anywhere accessibility; and global connectivity.

Keywords: Return on investment, retention; learning analytics; data analytics

Introduction

Higher education institutions are grappling with the crucial issue of retention, which is often defined as the process that leads students to remain within the study program and institution in which they enrolled to earn a degree (Mah & Ifenthaler, 2017, 2018). The *Higher Education Standards Panel* report of 2017 outlines related concerns including: raising expectations for completion rates, enhancing access to information, transparency and accountability; and improving articulation across the tertiary sector. In addition, the report points out the need for strengthening outreach, providing career advice and support services to assist with completion, creating intermediate qualifications, creating, embedding and sharing innovative practices including international models, and regulating the system for effective and efficient use of government resources (Higher Education Standards Panel, 2017).

A broad but pressing research question for improving retention is: given the need to prioritise and address these kinds of concerns, how can actionable data be provided and insights supported to the right stakeholders at various levels of the organization? Return on investment (ROI) for higher education institutions is conceptualised as the potential of a desired impact in relation to the effort needed to develop a causal intervention such as a new learning experience or an enhancement to an existing one (Psacharopoulos, 2014). Retention ROI is often summarised as potential tuition retained or as potential revenue lost. But ROI can also be expressed with other costs and benefits, such as *faculty time*, *appropriate selection and implementation of interventions*, and *university reputation lost* if students return home unsuccessful and the news spreads by word of mouth to friends and community (Menon, 2014). Data analytics presents a unique challenge, but also opportunity for higher education, offering means to automate historically complex and resource-intensive processes. With such opportunities, universities must clearly articulate their value proposition, and adapt to a more customer-focused approach to the management of education (Buckingham Shum & McKay, 2018).

In this article, data analytics initiatives that have gained traction at a university in Western Australia are discussed. These initiatives are action research based (Argyris & Schon, 1974). At the macro level, insights are being delivered that help faculty staff to target retention initiatives. At the meso level, reports are being delivered to lecturers in order to enable widespread data-driven teaching improvement opportunities. At the micro level, 'at-risk' student lists are being provided to student support staff, enabling them to triage and prompt individual students to take corrective action. By injecting information at all three levels, and by observing how the data is used, awareness of the university system and data-informed action is improved, which is itself a measure of success.

Profiles of analytics tools and methods

The university’s analytics team in the learning and teaching (L&T) area is tasked with delivering benefits to students and staff through the use of learning analytics, educational data mining and academic analytics. Since 2016, the team has created an initial catalogue of data products aimed at a variety of key stakeholders in learning, teaching, and curriculum design (Gibson, Huband, Ifenthaler, & Parkin, 2018). Each of the products targets a different level of the system, and has been met with varying levels of adoption (see Table). Given the adoption levels, the greatest ROI can be attributed to the Student Discovery Model (SDM) Insights, the Integrated Reports, the Disengaged Student List, and the Irregular Enrolment Student List. These are discussed in further detail below.

Table 1: System level of the intended actor and level of adoption of available data products

Data Product	Description	Level	Adoption
SDM Retention Data Pack	Per-student Excel retention data, with multiple enhancements (e.g., handling of replacement packages and majors/streams).	Macro	Poor
SDM Insights	Insights that are built on top of the SDM Retention Data Pack.	Macro	Good
Integrated Reports	Available to all teaching staff according to their LMS access.	Meso	Good
Disengaged Students List	Enables staff to identify and contact students who have not been assessing one or more of their LMS sites.	Micro	Good
Irregular Enrolment Student List	Enables staff to identify and contact students enrolled in units that aren’t expected to be attempted until a subsequent study period or year.	Micro	Good
Unit Outcomes (aka <i>Pass Rates</i>)	Enables insights into pass rates, withdraw rates, average marks, unit enrolments, and other outcomes, for different cohorts.	Macro	Average
Enrolment Trends	Visualizing year-on-year enrolment trends.	Macro	Poor

Analytics for divisions and schools: SDM insights

A criticism of the original SDM was that relevant stakeholder actors did not have any access to the underlying data. The SDM Retention Data Pack helped to address this criticism, but in practice the sheer size and dimensionality of the data makes it inaccessible to most staff. Instead, L&T has itself leveraged the data pack in order to deliver faster turnaround times to analytics queries, and at a level of granularity and business sensitivity that enhances the offerings of the university’s Business Intelligence area. For example, in the second half of 2018, L&T was asked to provide insights into the performance of an undergraduate ‘feeder’ program, which exists as a pathway for successful first year students to gain admission into other programs to which they cannot be directly admitted. Although the feeder program was criticised as having a significantly worse retention rate than other programs in the same faculty, L&T was able to show that when comparing ‘like-for-like’, performance was near comparable to other ‘normal’ degree programs (see Figure). Key to this was the ability to limit historical analysis to students in their first academic year, a capability that is not currently possible through other systems at the university, and yet is crucial in this case, as the feeder program is predominantly comprised of first year students. This scenario illustrates how different audiences at different levels of the same organisation can have conflicting views of the same underlying student information.

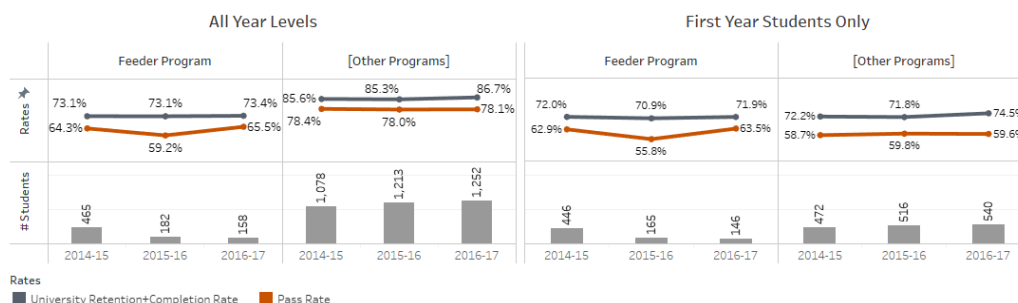


Figure 1: Year-on-year retention and pass rates of the feeder program versus other programs

SDM Insights has also become a key source of data for a number of the schools at the university. School engagement begins with an overview of year-on-year retention data, which incorporates three enhancements over other data sources.

First, what constitutes a ‘program’ is allowed to vary from the strict encoding used by the Student Information System (SIS) by disaggregating overly large programs into majors of study and ‘common core’ first years. This insight helps create focus and priority for action, saving time and money.

Second, details are only presented for programs with the highest number of attritions, with other programs being aggregated into a single group. This feature helps people target their intervention efforts, again focusing effort and high-value actions.

Third, in addition to presenting a traditional retention rate calculation, both pass rate information and a combined ‘retention + completion’ calculation are presented. This latter calculation is not a standard metric at the university, and yet is helpful to several stakeholder actors, as it provides a more holistic view of the ‘success rate’, and is a more stable measure than the traditional retention calculation, particularly for short programs.

The year-on-year overview offers no detailed information on the nature of the attritions, nor does it allow for ‘false positives’ involving students who return to studies after ‘attrition’ gap years. The concept of ‘lifetime’ attrition is used by the SDM to address the second issue, where the status is calculated only once per student per program (not yearly). The lifetime attrition status of each student is calculated relative to the first year of their program, and students are only considered a university attrition if they have not subsequently completed any program at the university, and if they did not undertake any studies at the university in the last full calendar year. Schools are then presented a view that only includes lifetime attritions (see Figure 2).

This view categorises lifetime attritions by how far through a program the student managed to progress (credits accrued x-axis), and by their performance in the program (outcome y-axis), and can be tabularised for schools so that they can review the academic transcripts for students in areas of concern. This enables schools to quickly assess if attritions are occurring early or late in studies, and if attrition relates to low or high performing students. The insights gained here help ROI by pinpointing timing as well as the structural focus of interventions.

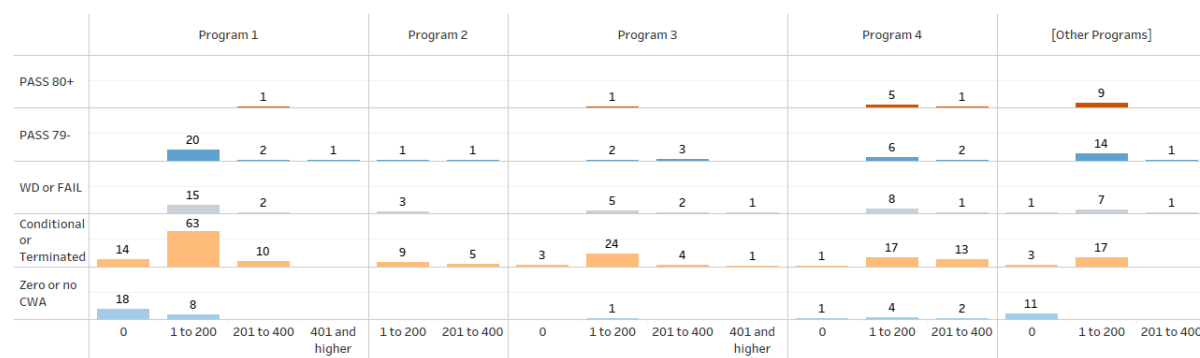


Figure 2: Lifetime attritions by credits accrued and attempt outcome

Feedback from faculty staff on this view of retention data has been positive, with one of the key stakeholder indicating it *“has underpinned the conversations, and subsequent initiatives and development, to support further improvements of our student retention [and has] allowed for deeper understanding across several factors, [...] which has lead the discipline areas to investigate further into the reasons and factors that might explain [the loss of high performing students] with a view to design and communicate ways to reduce this.”*

Tools for teachers: Integrated reports

Reports integrated with the Blackboard Learn LMS offer nightly updated views of student background information, student engagement with unit materials, current grade scores, and types of work submissions. Five reports provide teachers with different views of these meso-level data (see Table 2). Feedback from staff suggests they often leverage the Student-at-a-Glance report in the context of student appeals, as it includes an ‘audit log’ of all of the engagement and submission activity for a student. Other feedback has highlighted the benefits of simple functionality in the Student Background that lists the number of students enrolled in a unit by their program (or ‘course’ as it is known at this university) of study. This data has had a beneficial non-financial ROI impact on teaching, because previously teaching staff often had poor visibility over the programs of study into which their set of classes was being offered. With the goal of maximising the ROI of the integrated reports, a communications plan was implemented at the start of 2018, and continued into 2019. Five distinct communications are emailed

during each semester to all lecturers, each flagging a single use case, including student background review, identification of disengaged students, identification of under-performing students, review of student engagement and performance, and unit content review. The communications have successfully resulted in an uplift in the usage of the reports, but overall usage is still relatively low, with only 15.6% of 2019 Semester 1 units having leveraged the reports. In reflecting on the relatively low rate of usage, we are planning to incorporate more personalised messaging to staff in a subsequent communications cycle.

Table 2: Blackboard Learn LMS integrated reports

Report	Provides	Usage
Student Background	Information about the background of the students in the LMS site.	Through better understanding, help to enable teaching to be tailored to the needs of the cohort.
Unit Activity	Information about the overall activity of the students in the unit.	Learn how active students compared to their other units, as well as when they are most/least active.
Item Activity	Information about student interaction with the unit content.	See the level of activity that students have with each item in the unit, and when they are accessing it.
Contribution and Performance	Information about the contribution and performance of students in the unit.	Learn how students' activity in the unit correlates to their grade, and what students are submitting and when, and what their grades are for each item.
Student-at-a-Glance	Consolidated information about a particular student.	Compare how a student is interacting and performing compared to the rest of the unit.

Methods to identify and assist students-at-risk

A pilot Student Retention Prediction system was unsuccessful because the target measurement was based on a timeline that was too long for 'student success workers' to make timely use of the insights. Despite this, there remains a healthy appetite for initiatives targeting students-at-risk, particularly in anticipation of government imposed performance-based funding (Department of Education and Training, 2018). As such, L&T has initially chosen to focus on identifying at-risk students via simple heuristics that are easy to interpret and triage.

Disengaged student list

A problem experienced by the university involves students who do not sufficiently engage in an enrolled unit, which can result in a 'fail incomplete' with a mark of 0. In extreme cases, students might not remember they were enrolled for an entire year, resulting in unnecessary fees and poor academic transcripts, which in turn reflects poorly on the university with respect to government measures around student success and retention. Some staff use LMS functionality to identify disengaged students on their own initiative, but this practice only happens in a relatively limited number of units. To address this, in 2018 L&T piloted a university wide consolidated list of disengaged students, enabling all faculties to identify and contact students deemed to be at-risk due to never having accessed the LMS materials for one or more of their units. By 2019, this initiative has been through several action research cycles, and it has become standard practice for each faculty to leverage the data prior to the semester 1 and 2 census dates. Although the list is conceptually simple, in practice it has proven to be tricky to eliminate false positives. For example, of the 2,236 unit enrolments in the 2019 Semester 1 list, 80% were flagged as being possible false positives. Students may also be inactive in some units, but active in others (i.e., partially engaged), perhaps because there has yet to be a strong need to access some units (e.g., no early assessment). Consequently the system is not yet ready for automation. False positives considered include:

- Incarcerated students, who cannot access the LMS.
- Students seeking recognition of prior learning, who may believe that it is pointless to engage with the unit.
- Some teachers deliver material using a different (non-standard) LMS, to which access is not tracked.
- Automation at the university creates LMS sites, even if there is little or no unit material to host.

Irregular enrolment student list

Students sometimes study units at the university in an atypical sequence, by enrolling in units that are not expected to be attempted until a subsequent study period or year. Whilst this may be intentional in some cases, for example to exploit the flexible study options, it is frequently the case that such decisions are inadvertent. Poor choices can result in study plans with complications, potentially affecting retention, performance, and the student experience. In one case, a high-performing student inadvertently studied a second year unit instead of the expected first year

unit, and as a result of this 'irregular enrolment', it will not be until their third year that their study plan will return to a 'normal' state. This single mistake has caused the following issues:

1. The student has had to study a unit of higher difficulty than expected, without all of the 'scaffolding' intended by the program designers.
2. The student has had to meet with academic staff to obtain pre-requisite waivers, and to be granted permission to overload their studies, in order to circumvent unit availability constraints that would otherwise have delayed their anticipated graduation date.
3. The student has had timetable clashes, as a result of studying non-standard combinations of units.

In 2019, L&T produced a university-wide dataset to enable staff to identify and contact new-to-program undergraduate students with irregular enrolments such as this. The first run identified 1,240 students with enrolments that did not strictly follow the template specified for their study plan, with 23% of the students having selected a unit of the wrong year level. Even though the list was provided on short notice, the data was well received by faculty staff, with feedback such as "*it was very useful for identifying students incorrectly enrolled*" and "*all [in this program] were incorrectly enrolled (so what a neat report that is!!)*". Anecdotal feedback also indicates that students were grateful to have been contacted about their irregular enrolments.

Conclusion

Alongside the evolving social and organizational context, higher education must transform its processes to accommodate new conceptualizations of student capability and success (Vey, Fandel-Meyer, Zipp, & Schneider, 2017). In particular, universities must reconsider five important dimensions of higher education learning and teaching operations: finding and selecting students; knowing learners and their expectations; just-in-time services, content, mentoring and support; anytime, anywhere accessibility; and global connectivity (Henry, Gibson, Flodin, & Ifenthaler, 2018). The findings of this action research are limited as they are of preliminary status. Our current efforts focus on reflecting on the impact at all stakeholder levels as well as through deep data analytics strategies with a longitudinal perspective.

To sum up, with technology offering significant opportunities to enhance access and success in higher education, technology-enabled learning and teaching approaches present an important avenue for innovations, facilitating unique opportunities to identify and develop talent for today's university and beyond.

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